

**Proposal Title:** Seasonal Prediction for Ecosystems and Carbon Cycle Using NCEP/CFS and a Dynamic Vegetation Model

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### **Abstract**

In recent years, many advances have been made in the science and practice of seasonal climate predictions. For example, seasonal climate predictions have attained operational status and have come to rely increasingly more on dynamical prediction models. Such advances notwithstanding, application of seasonal climate outlooks to applications of societal importance has been slow to materialize. The aim of this proposal is to develop one such application, i.e., *a capability to forecast terrestrial ecosystem productivity and carbon sources and sinks on seasonal-interannual time-scale*. The modeling system is global, but the focus of validation and application will be for North America.

The development of an outlook capability for the ecosystem will rely on several components that have evolved following independent pathways and have reached a state of maturity in their respective domains of interest. The key effort of this proposal will be bringing together these modeling and prediction component systems.

The modeling components of the proposed predictive capability include:

1. A dynamic Vegetation-Global-Atmosphere-Soil (VEGAS) model with full terrestrial carbon cycle
2. Operational climate forecasts at the Climate Prediction Center and dynamical seasonal forecasts based on the Climate Forecast System (CFS) (both at NCEP)

Specific tasks under the proposal will include (and will build upon a prototype carbon cycle prediction already in place):

- Developing a procedure to specify vegetation and soil initial conditions derived from some form of data assimilation system
- Developing procedures to forecast ecosystem and carbon variables using ensemble climate prediction information from CFS
- Validation of prediction system based on hindcast skill by comparing model predictions against a suite of observed variables such as satellite vegetation index, CO<sub>2</sub> flux measurements, and assimilated carbon fluxes
- Comparison of the CFS based skill with other baseline estimates of skill for predicting eco-carbon variables, e.g., prediction based on operational CPC forecasts
- Testing the prediction system in a real-time operational setting, getting feedbacks from a wider community, improving the system.

Deliverable of this project will be a seasonal forecasting system for terrestrial ecosystem productivity and carbon fluxes that later will be transitioned to operations using the Climate Test-Bed (CTB) infrastructure.